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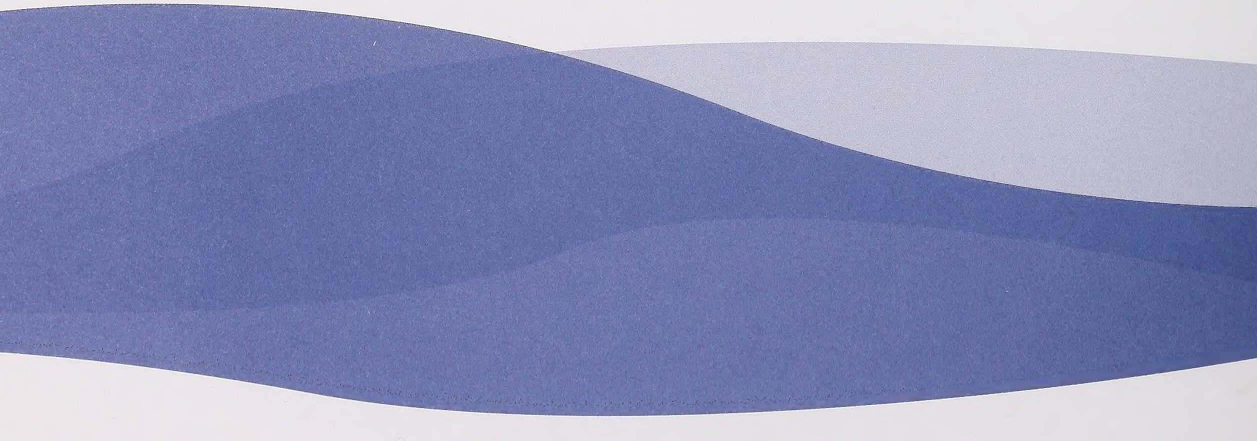
Advisory Committee on Water Use Practice and Policy

Preliminary Report

March 31, 2004



March 31, 2004

Honourable Lorne Taylor
Minister of Environment
Government of Alberta
423 Legislature Building
Edmonton, Alberta

Dear Dr. Taylor:

We are pleased to submit this preliminary assessment concerning underground injection uses of water on behalf of the Advisory Committee on Water Use Practice and Policy. We trust that you will find the report a useful contribution to the ongoing challenges of managing Alberta's water resources in the face of increasing economic and population growth, and scientific uncertainty about future supplies. The Committee appreciates the opportunity afforded to it to provide advice on these matters.

The Committee held 7 meetings between October 7, 2003 and March 23, 2004. The Committee was exposed to detailed information on underground injection activities in Alberta, primarily concerning enhanced oil recovery operations. The Committee discussed the associated issues and challenges, and carefully considered its recommendations in the context of *Water for Life: Alberta's Strategy for Sustainability.*

A series of proposed recommendations are included with respect to the *Water Act*, EUB Guidelines, Water Data, Industry Practices, Performance Measures, Research and Knowledge, and Public Communications.

The members of the Committee feel that although significant progress was made in analyzing a wide range of challenges and evaluating solutions, an opportunity for stakeholder input is required to refine proposed changes to policy and practice. An opportunity for the general public to respond to the proposed recommendations is also recommended.

We therefore submit this report with the recommendation that further time be allocated to the Committee to receive feedback and advice on the document. We propose that stakeholder and public input processes occur during April and May 2004. Attention should be focused on the following matters in particular:

1. The expansion of the Groundwater Allocation Policy to include both ground and surface waters throughout the province.
2. The use of voluntary reviews, by permanent licence holders, to identify unused water allocations.
3. The future use of allocation transfers under the *Water Act* to (and from) underground injection licence holders.

Following this process, we forecast that the committee will have a final report to your office no later than June 30, 2004.

Respectfully submitted – March 31, 2004

D.O. Trew

D. O. Trew
Chair

D. Pryce
Co-Chair

M. Griffiths

Dr. M. Griffiths
Co-Chair

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Executive Summary

Concerns about water use for underground injection purposes arose during public discussions of *Water for Life: Alberta's Strategy for Sustainability* in 2002. Many Albertans identified the need for an increased emphasis for water conservation, and some expressed concerns over the use of water for underground injection activities, arguing that these activities remove water from the active water cycle. As a result, a multi-stakeholder committee (the Advisory Committee on Water Use Policy and Practice or "Committee") was created to examine whether changes are needed to improve management of water related to underground injection.

The Committee concluded that Albertans are primarily concerned about *long term loss of water* when it is injected underground. Water licences have been issued in this province to companies that inject non-saline water underground since the 1950s, but the issue gained significant profile in 2002 as the need for water conservation was emphasized during the *Water for Life* discussions. Albertans expressed concerns with this use of water, as other demands for water increase and supplies may become fully allocated in some basins.

The Committee reviewed legislation and policy, current industry practices and information about the use of water for underground injection. The Committee found that government agencies have acted responsibly and companies have met, and in some cases exceeded, current requirements. This has resulted in reductions in non-saline water use, particularly by the oil and gas sector, over the past three decades. In keeping with *Water for Life*, the Committee concluded that further efforts to improve conservation are warranted because of increasing demands for water and uncertainties about long-term supply.

The Committee does not feel that immediate, province-wide elimination of underground injection of non-saline water is a reasonable response to public concerns because of current technical and economic considerations. Instead, the Committee believes a measured approach is warranted to achieve further reductions in non-saline water use, which could result in elimination in some situations. Some members of the Committee support the long-term elimination of injection of non-saline water.

In order to ensure the best management of water, while recognizing that hydrocarbon resource recovery is important to the economy of the province, the Committee recommended a cooperative approach[1] in which government and industry work together to achieve significant conservation improvements. They noted the process used by the Clean Air Strategic Alliance Flaring Project Team to reduce flaring of gas at well sites has established a successful precedent. A similar approach for management of water injection should be based upon a "decision tree" which sets out expanded criteria for evaluating and approving alternative methods and water sources for all underground injection activities.

Guidelines and Principles

The Committee believes that the principles stated in *Water for Life* should guide all decisions about water management. In addition, the Committee identified specific guidelines for future water management decisions about underground injection.

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[1] "Cooperative approach" refers to a specific approach to achieve mutual goals. Following the example of the flaring discussion, this approach would be backed up by a mandatory regulatory requirement, which would be instituted if the cooperative gains were not achieved.

Summary of Recommendations

The Committee feels opportunities for further reduction in the use of non-saline water for underground injection **must** be pursued. In addition, Albertans must have better access to information about underground injection of water, and must be assured that such use is being closely monitored. The Committee's recommendations included the following changes[2]:

- Applicants for water for underground injection purposes should be required to identify and assess alternatives to non-saline water sources. Where feasible alternatives exist, access to non-saline water sources should be restricted in future.
  - The Committee suggested the existing Groundwater Allocation Policy for Oilfield Injection Purposes be strengthened and clarified to reflect this requirement.

- Criteria and decision processes should be strengthened to guide the review of applications for water for underground injection. Economic and environmental criteria should be clearly described to ensure that applicants and regulators fully understand the basis for future decisions.

- Industry should undertake an immediate review of existing allocations for underground injection processes to determine actual and planned quantities required and adjust where appropriate.
  - The Committee expects a substantial reduction in allocation could be achieved through this review.

- A provincial water conservation plan should be established (as supported by *Water for Life*). This should identify potential reductions in use of non-saline water for all sectors. Implementation should be monitored and reported on a provincial, watershed, and municipal boundary basis.

- Policies and guidelines should be revised to achieve improved conservation of non-saline water sources. These revisions would affect all relevant government guidelines and policies.

- Research regarding alternate technologies (that reduce non-saline water requirements) for underground injection practices should be increased through industry-government partnerships.

- A publicly accessible database is required. Additional information on underground injection practices needs to be gathered and provided to the public.

- The implications of limiting the use of non-saline water in EOR operations should be reviewed, and options should be studied for addressing situations where energy resources are stranded.

The Committee has made an effort to represent the needs and expectations of a wide range of stakeholders, but recommended further efforts to consult with stakeholders and ensure the proposed responses will create positive changes and not create unforeseen problems.

The following report includes guiding principles and specific policy and communication adjustments which the Committee members believe will result in improved management practices for the use of non-saline water for underground injection purposes. The Committee recommends the situation be re-examined after five years to confirm results, to incorporate other direction from *Water for Life*, and to assess technical opportunities and competitive factors that may open the way to further conservation measures.

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[2] All recommendations are preliminary and should be tested with stakeholders to ensure they will create desired outcomes.

Purpose of the Committee

During the *Water for Life* public consultations, many Albertans voiced concerns about the sustainability of activities that remove water from the hydrologic cycle. Such activities in Alberta include:

- Deep well disposal of industrial wastewaters;
- Water used for creating salt caverns; and
- Water used for the enhanced recovery of oil and bitumen through water and steam injection processes.

Specifically, Albertans stated they are concerned that this use of water is a "permanent loss" of water that does not appear compatible with sustainable water management in the province. They also identified concerns that this use of water may reduce the amount of water available for other water uses.

The role of the Advisory Committee on Water Use Practice and Policy (Committee) was to review current practices and policies, and identify potential options to reduce the amount of non-saline water used for underground injection purposes.

The Committee attempted to assess whether these options are practical (i.e. does the benefit of implementing an option merit the cost of making changes?).

The Committee also provided guidance about long-term changes that may improve water conservation.

As part of its work, the Committee considered:

- Policy changes to reduce use of non-saline water for underground injection
- Recommending changes to industrial practices to reduce use of non-saline water
- Improving communications to companies practicing underground injection
- Improving communication to stakeholders and public
- Improving research, data collection, storage and access

Guiding Principles

The Committee believes the principles from *Water for Life* provide valuable guidance for water management in Alberta. The Committee added decision guidelines to augment several of these principles to clarify expectations about decisions regarding underground injection of water.

***Water for Life* Principles**	**Decisions about underground water injection should**
All Albertans must recognize there are limits to the available water supply. Albertans must become leaders at using water more effectively and efficiently, and will use and reuse water wisely and responsibly.	Minimize the volume of non-saline water used for underground injection. Promote and support sustainable development practices. Allow transition times for affected sectors to avoid "economic shocks" and impractical technologies.
Citizens, communities, industry and government must share responsibility for water management in Alberta, and work together to improve conditions in their local watershed.	Respect the expectations of Albertans, who regard water as an important part of their heritage. Consider whether affected stakeholders and knowledgeable experts have been consulted and have had an opportunity to contribute their advice. Ensure fairness to all affected parties.
Knowledge of Alberta's water supply and quality is the foundation for effective decision-making.	Incorporate the best available knowledge and science, and note gaps or assumptions where improved information is needed. Recognize and build on past efforts.
Alberta must preserve the "first in time, first in right" principle for granting and administering water allocations, but water allocations will be transferable to ensure societal demands and needs can be met.	Create desirable outcomes for Albertans, including recognition of the benefits of industrial uses of water.
Healthy aquatic ecosystems are vital to a high quality of life for Albertans and must be preserved.	Consider both short-term and long-term effects on society and environment.
Groundwater and surface water quality must be preserved in pursuing economic and community development.	Minimize risks to human or environmental health by ensuring that monitoring and contingency response is in place for unpredictable future risks.

Current Situation

Albertans who commented on *Water for Life* were concerned about the use of non-saline water as a fluid for underground injection. Both government and industry have recognized that further efforts to reduce the use of non-saline water sources for injection are important at this time. However, Albertans benefit from income and royalties that accrue from the recovery of oil and gas through enhanced oil recovery (EOR) methods (i.e. methods that commonly rely upon injection of water underground). These realities underline the complex challenge of assessing EOR practices.

An important first step within the proceedings of the Advisory Committee on Water Use Practice and Policy was to develop a common understanding of the current water situation as it relates to enhanced oil recovery practices, allocation principles, and actual water use. The following section briefly describes some of the facts the Committee considered during its discussions.

For a more thorough look at the use of water for EOR, (and a definition of terms) refer to *Water and Oil: An Overview of the Use of Water for Enhanced Oil Recovery in Alberta* (download from www.waterforlife.gov.ab.ca or call (780) 427-2700 for a printed copy).

Water Allocation in Alberta

According to Alberta's *Water Act*, all agricultural, industrial, municipal and other non-domestic water users must apply to Alberta Environment for a licence to divert and use an annual allocation of water. In Alberta, water is allocated on the principle of *first-in-time, first-in-right* for both surface and groundwater resources. This principle, which has existed since 1894, means water diversions are prioritized according to the seniority of a licence, regardless of use (the older the licence, the higher the priority).

Before any application to divert water is approved, Alberta Environment reviews the application to ensure existing water users' rights are protected, that water is available to meet the needs of the applicant and any potential impacts on the aquatic environment are minimized. This process also applies to licence applications for EOR operations.

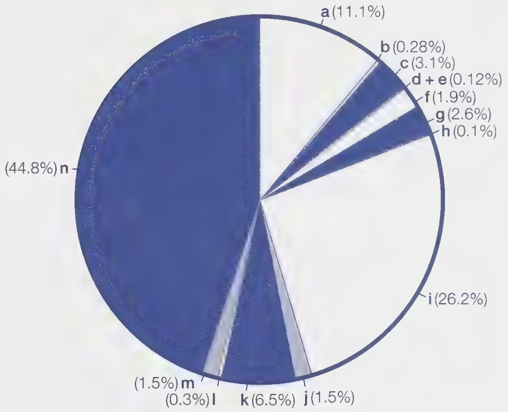
Household water use is a *statutory right* and has the highest priority of all water diversions. This applies to households that are not part of a municipal water system. In these cases, up to 1,250 cubic metres (m^3) of water per year can be used[3], from any water source accessible at that location.

Where has Alberta's Water Been Allocated?

Water is used for a variety of purposes in the province and Alberta Environment keeps records of all water that is allocated. These allocations are based on the expected maximum amount an applicant may require annually. However, they do not represent actual water use or actual amounts of consumption.

During 2001, Alberta allocated over 9.4 billion m^3 of water for a variety of uses. Allocations from surface water sources accounted for 98 per cent of this total; the remaining 2 per cent was from groundwater sources. Water allocations for specified uses are illustrated in Figure 1.

Figure 1: Allocation by Specified Purpose



a	Municipal
b	Recreation
c	Water Management
d	Other Purpose Specified by the Director
e	Wildlife Management
f	Injection (Oil Recovery)
g	Industrial (Oil, Gas, Petroleum)
h	Drilling (Developing Oil/Gas Wells)
i	Commercial (Cooling)
j	Agricultural
k	Commercial
l	Fish Management
m	Habitat Enhancement
n	Irrigation

For more information on hydrology in Alberta, refer to the presentations and fact books presented to the Committee at: www.waterforlife.gov.ab.ca/html/removed.html

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[3] 1 m^3 is equivalent to 1000 litres or 264 US gallons or 220 Imp. gallons

Water Allocation and Use in the Oil and Gas Sector

The report *Water Use for Injection Purposes in Alberta* provided the Committee with the most accurate water use information up to 2001. The Committee used this and allocation information from Alberta Environment as the baseline for their discussions. While more recent water use data is available, it has not yet been verified to ensure complete accuracy.

Enhanced oil recovery (EOR) processes increase the amount of oil produced from a well. In most cases, water is injected underground into conventional wells to increase the pressure and force out some of the remaining oil. Water can also be used to recover oil from oil sands through the injection of steam to heat and mobilize the crude bitumen. Note: large, open-pit oil sands mining operations are not considered in this discussion of EOR.

For 2001, the oil and gas sector was licensed to use 4.6 per cent of all non-saline water allocated in Alberta (Figure 1). Less than half (1.9 per cent) of this water is allocated for water and steam injection operations. By comparison, the agriculture sector (including irrigation) was licensed to use the largest amount of water of any economic sector, at approximately 46 per cent. Municipal water supplies accounted for 11 per cent. (Note: these percentage figures do not represent actual use or consumption trends).

How much water does the oil and gas sector use for enhanced oil recovery?

In 2001, a total of 276.4 million cubic metres of water was injected for EOR operations in Alberta. Of this total, 228.9 million cubic metres (83 per cent) is re-injected saline water recovered naturally with oil from underground reservoirs (referred to as *produced water*). The remaining 47.5 million cubic metres of water injected (17 per cent) was obtained from surface or groundwater sources (saline and non-saline) external to the oil reservoir (referred to as new *source water* or *"make up" water*).

Of this amount:

- 37.1 million cubic metres (78.1 per cent) was from non-saline, or fresh, sources and
- 10.4 million cubic metres (21.9 per cent) was saline water.

Of the 37.1 million cubic metres of non-saline water injected:

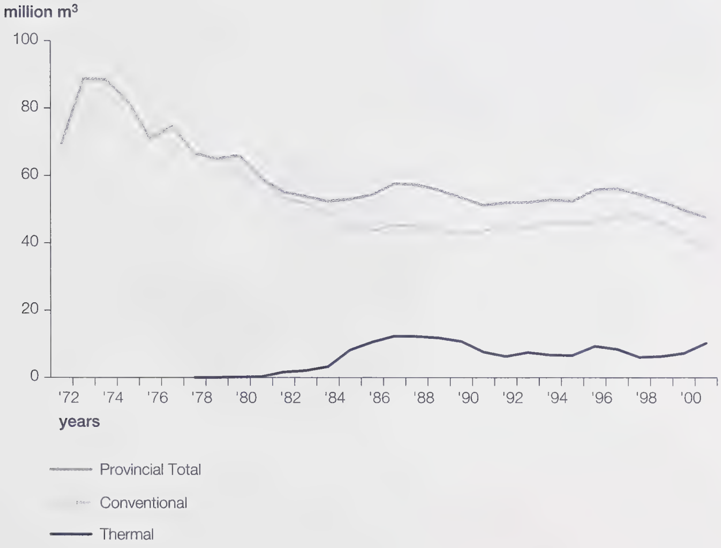
- 26.9 million cubic metres (72.5 per cent) came from surface water sources, and
- 10.2 million cubic metres (27.5 per cent) was sourced from groundwater.

Source: Water Use for Injection Purposes in Alberta report, AENV, 2003, www.waterforlife.gov.ab.ca/docs/geowa_report.pdf

Water Use Trends for Enhanced Oil Recovery (EOR)

Since the mid 1970s, the use of water for *conventional* oilfield injection activities has been declining in Alberta (Figure 2), due to improved water recycling efforts by industry, and a general decline in the remaining, recoverable oil resource in existing, conventional EOR projects. However, overall water use in *thermal* recovery projects has increased.

Figure 2: Source Water Diversion for Oilfield Injection – Total Source Water Used

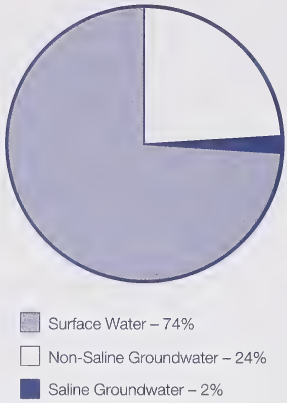


The total volume of *source water* used has declined from 69,497,060 m^3 in 1972 to 47,525,748 m^3 in 2001[4] (Figure 3).

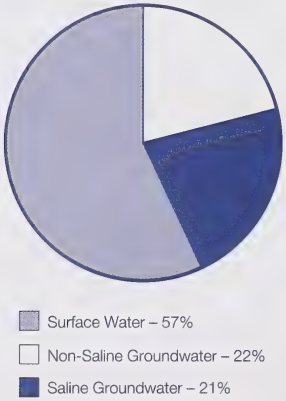
Recent advances in technology have also enabled the use of some saline groundwater in steam generation processes, as a portion of the total source water needed. Overall, the use of saline groundwater has increased as a proportion of the total source water used in *conventional* and *thermal* EOR projects in Alberta (Figure 3).

Figure 3:
Source Water Diversion for Oilfield Injection

1972 Oilfield Injection Total Volumes
Source Water Total Diversion = 69,497,060 m^3



2001 Oilfield Injection Total Volumes
Source Water Total Diversion = 47,525,748 m^3



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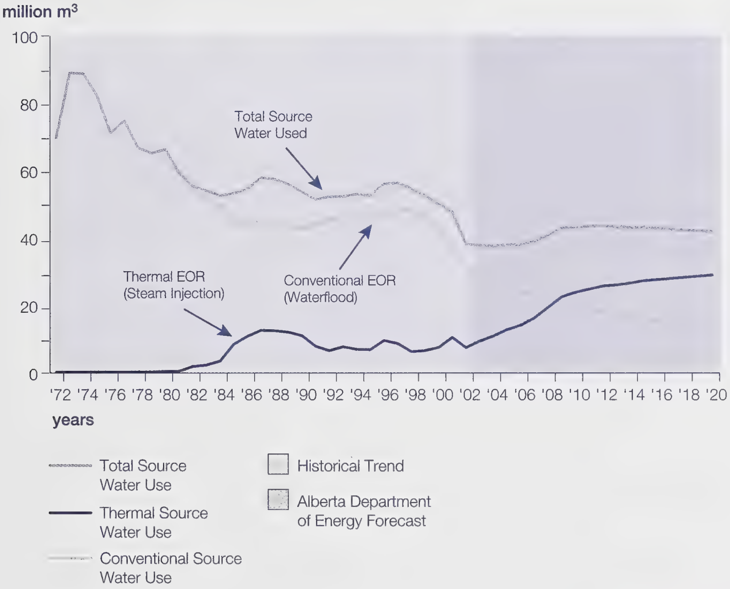
[4] Preliminary data indicated that total source water use for 2002 was 47,109,928 m^3.

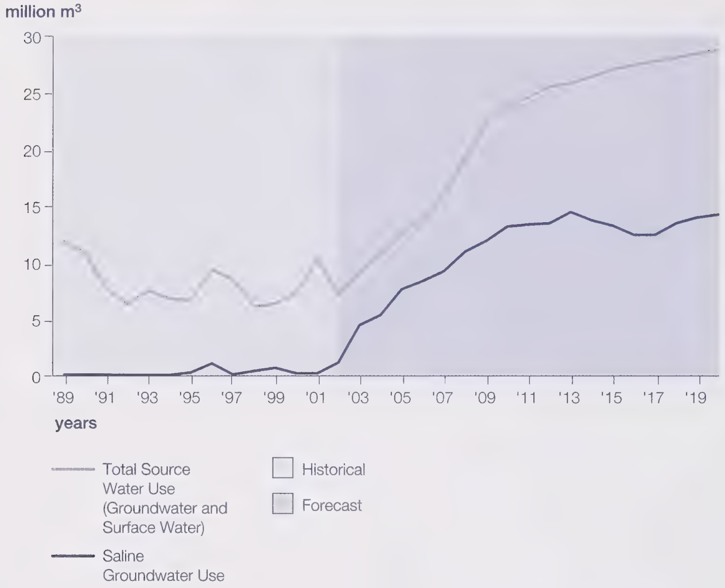
The future trends in *thermal* and *conventional* water demands are illustrated in Figure 4. Source water required for conventional oil recovery will continue to decline, whereas water demand for thermal recovery operations will continue to grow.

Figure 4: Enhanced Oil Recovery –
Total Source Water Use (Historical and Forecast)



Further increases in saline water use are expected to occur at both new and existing thermal recovery projects. This may help reduce the need for surface water and non-saline groundwater resources during development of Alberta's oil sands deposits (Figure 5).

Figure 5: Future Water Use – Thermal EOR



Source: AENV Science and Standards Branch 2004

Economic Considerations

More than 50 per cent of Alberta's production of conventional light oil each year is now supplied by EOR projects. In 2001, $447 million in direct royalties were generated from conventional and thermal EOR activities. These royalties help to provide the funds needed to deliver core public programs in Alberta such as health, education and infrastructure.

The use of water in EOR projects is currently the most common practice and considered the most economic option by the industry. As with all water uses, however, many Albertans have concerns on the effects to the environment and aquatic ecosystems. They want to be assured that water is being used responsibly.

Environmental Considerations

Water for Life identifies key environmental goals essential to the maintenance of healthy aquatic ecosystems and safe, sustainable water supplies.

Environmental considerations in developing sound policy and practices regarding the underground injection of water include:

- Increasing demand on water supplies for economic and population growth puts pressure on the natural environment.
- There is a fundamental variation in the water supply available from year to year and from place to place. This results from variability within the natural hydrologic cycle. Uncertainty regarding the potential for effects on the available water supply due to climate change in Alberta must be considered.
- Cumulative effects on surface and groundwater systems must be acknowledged.
- Underground injection activities result in a long-term loss of water.
- Water conservation, in all economic sectors, has been identified as a key initiative of *Water for Life.*

Policies Related to Enhanced Oil Recovery

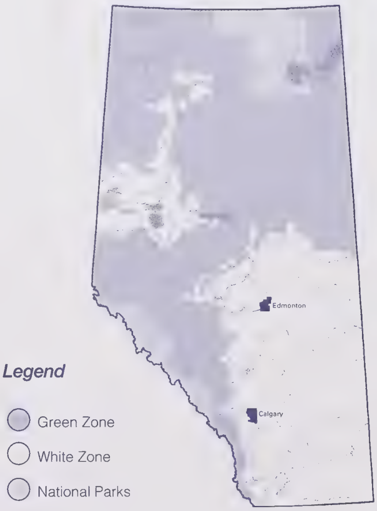
There are several regulations and policies that oil and gas operations must follow when diverting and using water in their activities. For example, Alberta Environment regulates the diversion of non-saline groundwater in the white zone of the province through the "Groundwater Allocation Policy for Oilfield Injection Purposes."

This policy requires oil and gas operations to investigate non-water alternatives and alternative sources of water before an application to use non-saline groundwater is made, and outlines quantity limitations and time limit restrictions on water diversions.

Policies concerning enhanced oil recovery

- ***Groundwater Allocation Policy for Oilfield Injection Purposes*** (AENV News Release, March 1990)
  This policy encourages the use of saline groundwater for oilfield injection in conventional oil pools and emphasizes the protection of non-saline groundwater resources used for domestic and agricultural operations in the settled area of the province (White Zone) – see Figure 6.
- ***Groundwater Evaluation Guideline*** (AENV 2003)
  This technical guideline specifies procedures and practices for evaluation and protection of groundwater resources. The guideline is used in preparation of *Water Act* applications (for licences to use non-saline groundwater in Alberta).
- ***Guide 23 - Guidelines Respecting an Application for a Commercial Crude Bitumen Recovery and Upgrading Project***
  (EUB, September 1991)
  This guideline sets out requirements and procedures needed to prepare an application for development of a commercial-scale oil sands mine or in-situ development using steam injection.
- ***Guide 51 - Injection and Disposal Wells: Well Classifications, Completion, Logging, and Testing Requirements*** (EUB, March 1994)
  This guideline specifies waste classification requirements, well construction and monitoring requirements, and safety measures regarding the underground disposal of liquid industrial and oilfield wastes.
- ***Guide 65 - Resources Applications for Conventional Oil and Gas Reservoirs***
  (EUB, Revised June 2003)
  This guideline specifies procedures and industry practices required for licensing and operation of conventional oil and gas recovery operations in Alberta. This includes applications for EOR using water flood methods.
- ***IL 89-5 Water Recycle Guidelines and Water Information Reporting for In Situ Oil Sands Facilities in Alberta*** (Informational Letter, EUB, May 1989)
  This information letter outlines government expectations, objectives and requirements for recycling of water used in steam injection (for recovery of bitumen from oil sands deposits).

Figure 6: Alberta's White and Green Zones



Proposed Recommendations

The Committee concluded that increased efforts to reduce the use of non-saline water for injection are warranted. However, the Committee did not feel that immediate, province-wide elimination of underground injection is a reasonable response to public concerns because of current technical and economic considerations. Instead, the Committee identified a measured approach that will lead to reductions in injection of water, and could result in elimination in some situations. Some members of the Committee supported elimination of the injection of non-saline water as the long-term goal. All parties must ensure the best management of water while recognizing that hydrocarbon recovery is important to the economy of the province.

A Provincial Water Conservation Plan

A provincial water conservation plan should be established (as supported by *Water for Life*). This should identify potential reductions in use of non-saline water for all sectors. Implementation should be monitored and reported on a provincial, watershed, and municipal boundary basis.

A Cooperative Approach

The Committee recommended a cooperative approach in which government and industry work together to achieve significant conservation improvements. They noted the process used by the Clean Air Strategic Alliance Flaring Project Team to reduce flaring of gas at well sites has established a successful precedent.[5] Following the example of the flaring management process, various tools including voluntary initiatives and regulatory requirements should be employed.

Decision Process to Guide Water Management

In support of the cooperative approach, specific criteria and a clear decision process should guide all future water management decisions regarding underground injection (i.e. a "decision tree"). This approach would:

- Emphasize the importance of minimizing or eliminating the use of non-saline waters.
- Define the criteria that should be considered to determine:
  - When the use of an alternative is economically feasible, and
  - When the use of a water supply presents a risk to: the sustainability of that supply; the water rights of other users; and the aquatic environment.
- Specify how potential "cumulative effects" of many applications in the same aquifer would be considered.

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[5] Clean Air Strategic Alliance, 1998. Management of Routine Solution Gas Flaring in Alberta: Report and Recommendations of the Flaring Project Team.

Range of Policies Affected

The Committee has proposed a number of changes that support the desired outcome of significant reductions in the injection of non-saline water. These include recommendations about:

- Provincial policies, guidelines and regulatory practices
- Industrial practices
- Data gathering and public information
- Research and knowledge
- Communications

The Committee supported the following recommendations:

Implementation of the *Water Act*

1. ***Use of water management plans***
   The Committee noted that the *Water Act* provides for water management plans, which could provide guidance on the allocation of water in each water basin, including allocations for injection purposes. The use of water management plans for this purpose would allow consideration of local conditions, expectations and requirements. Water management plans can include water conservation objectives, which specify the need to maintain water for the protection of the aquatic environment. The Committee recommended that water management plans should also provide guidance with regard to alternative sources and other issues relating to underground injection.

2. ***Adjustments to Allocations***
   With the understanding that both government and industry seek to conserve water resources in underground injection operations (both for environmental and economic reasons), the Committee noted that:
   - Alberta Environment should, in cooperation with industry, review *existing* oilfield injection term licences upon expiry to identify potential conservation improvements. New technologies, alternative sources, and reduced water needs should be considered.
   - Holders of permanent licences should be asked to review reasonable and practical opportunities for reduction in non-saline water use, and make voluntary adjustments.
   - Future licences issued under the *Water Act* for underground injection of non-saline water should specify regular allocation reviews (as operational requirements diminish), and strengthen requirements for monitoring and reporting of water use.

3. ***Other conservation issues***
   The Committee discussed, but did not finalize recommendations about (a) the use of water allocation transfers[6] and (b) the requirement for the government to compensate the operator if a water licence is suspended or cancelled to protect the aquatic environment. Further discussion is needed on these topics.

4. ***Improving management of underground water uses other than enhanced oil recovery***
   The Committee noted that water is used by both oil and other industries in operations where the intention is to dispose of industrial waste underground, or to excavate salt from underground caverns. These operations should be examined for potential conservation gains. This will require improved monitoring and reporting. The EUB and Alberta Environment should require reporting of the amount of water used, water sources and, where applicable, substances that are disposed with the objective of maximizing recycling opportunities and minimizing consumptive losses.

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[6] With approval of the Director, water licence holders may transfer all or part of their allocation to a party seeking a new allocation. The licence holder may sell the water right.

Groundwater Allocation Policy for Oilfield Injection Purposes

The recommended decision process ("decision tree") described by the Committee should become a key future reference in a revised version of this policy. The current policy identifies requirements for issuing groundwater allocations for oilfield injection purposes. The Committee also noted it already includes "due diligence" requirements related to protecting existing water users and the environment.

The Committee felt that direct reference should be made in this policy to *Water for Life*. The Committee also recommended expanding the scope of the policy to:

- Address the forested (Green) zone of the province (currently the policy is applicable only to the settled (White) zone).
- Utilize the site inspection provisions in the *Water Act*.
- Provide an initial two-year water licence for approved oilfield injection projects, to allow for verification of actual water use practices before the licence is renewed. (The existing policy only allows one year for review.)
- Require applicants to examine alternate sources and technologies, clearly noting the use of non-saline water is allowable only if other sources are not feasible (according to "decision tree"). Guidelines regarding preferred practices should be provided to the applicant.

The Committee identified the potential to include surface water sources (in addition to groundwater sources), but did not reach consensus on this possibility. The implementation of these recommendations may have practical implications and further stakeholder input on this matter will be an important consideration.

Alberta Energy and Utilities Board Guides

The Committee believes that relevant EUB documents should be amended to communicate the increased importance of water conservation to applicants. These documents should provide applicants with a cross-reference to Alberta Environment's water licensing process. The EUB and Alberta Environment should work together to ensure a coordinated and timely process for approvals. The Committee recommends the following specific changes to :

- Amend *Guide 65* to make direct reference to the importance of water conservation. Establish a formal link to Alberta Environment water policy and regulations.
- Amend EUB *Guide 65* to require applicants to identify water source(s) and water recycling plans.
- Apply EUB *Guide 7*[7] to ensure timely and accurate data are available for water production, injection and source volumes. EUB should address metering differences and errors in well status codes.
- Ensure that Alberta Environment approval for any non-saline water use is in place before EUB approval is given for an EOR project.

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[7] Guide 7 - Production Accounting Handbook (EUB May 2001). This guide provides the details and requirements for oil, gas and water measurement and reporting.

Data and Public Information

The Committee felt the establishment of a publicly accessible database of allocation and water use information is an important requirement to assure Albertans that water is being used wisely. This recommendation is noted in *Water for Life* and would affect all water uses, including underground injection projects. The first step toward achieving this goal will be to ensure compatible, consistent and timely data reporting and record-keeping by all operators, the EUB and Alberta Environment.

In addition, the Committee supports the need for a provincial inventory of groundwater supplies. The inventory should have information in a form that can be accessed and easily used by regulators, municipalities and water users. The Committee recognizes this inventory will require time and investment and proposes that areas where underground injection use is an issue be considered priorities for such an inventory.

Industry Practices

The Committee encourages industry to work with government in a shared effort to achieve desirable conservation gains. The Canadian Association of Petroleum Producers and other industry organizations should communicate the results of these shared efforts and promote best practices for water use.

Research and Knowledge

The Committee reviewed several avenues for improved research and knowledge regarding EOR technology including CO_2 injection, polymer floods, microbial floods, VAPEX, and toe-to-heel air injection.

In particular, there is potential for the use of CO_2 injection in Alberta and this method is known to be technically feasible. However, it requires a significant infrastructure investment (CO_2 capture, transport, and compression). While this could prove expensive, a full account of economic, environmental and social factors may support such investment in some areas of the province. The Committee recognized this practice does not eliminate the use of water, as some water is still required for most CO_2 injection processes.

The Committee also recognizes the need for additional delineation of non-saline and saline water resources. The Committee made the following recommendations for industry, government and research groups regarding research and knowledge:

- Prepare and distribute a summary of emerging alternate methods for EOR including timelines to commercialization and economic considerations.
- Stimulate existing and new partnerships between governments and industry to ensure that emerging alternative methods are developed and field-tested in both conventional oil and oil sands areas.
- Investigate the potential for further application of carbon dioxide as an alternate technology for EOR.
- Review the implications of limiting the use of non-saline water in EOR operations, and study options for addressing situations where energy resources are stranded (i.e., in situations where the energy resources are not recoverable by other methods).
- Investigate and expand available groundwater information to facilitate the responsible use of this water. This could include mapping saline and non-saline groundwater sources, collecting information from monitoring wells, examining contributing factors to changes in water table levels, and reviewing results of water well complaints.
- Increase water conservation and recycling research for industrial waste disposal and salt cavern washing operations, to minimize losses of water from the hydrologic cycle.

Performance Measures

The Committee concluded specific performance measures could not be developed until the appropriate data, including potential allocation adjustments, are available.

The Committee recognized the Provincial Water Advisory Council would begin development and implementation of conservation plans for all water use sectors with 2005 baseline information. With this in mind, the Committee recommended that water injection be included in water conservation plans, consistent with *Water for Life*.

The Committee further recommends that the newly-formed Provincial Water Advisory Council be asked to develop conservation targets and performance measures in cooperation with industry on the use of non-saline water for underground injection.

Public Communication

Committee members considered the need for improved public education about underground injection practices. They recommended the following actions to help Albertans understand the situation and the actions being taken to ensure good water conservation practices:

- Alberta Environment, in cooperation with other affected parties, should develop and implement a communications plan to inform Albertans about water use amounts, licensing and monitoring processes, trends and impacts.
- Industry associations should include community relations guidelines for members in the best practices documents.

Conclusion

The Committee has made an effort to represent the needs and expectations of a wide range of stakeholders. The members have identified proposals that they expect will result in improved water management. However, many of these recommendations will benefit from the advice of stakeholders. The Committee therefore recommended an effort to consult with stakeholders and ensure the proposed responses will create positive changes, without unforeseen problems.

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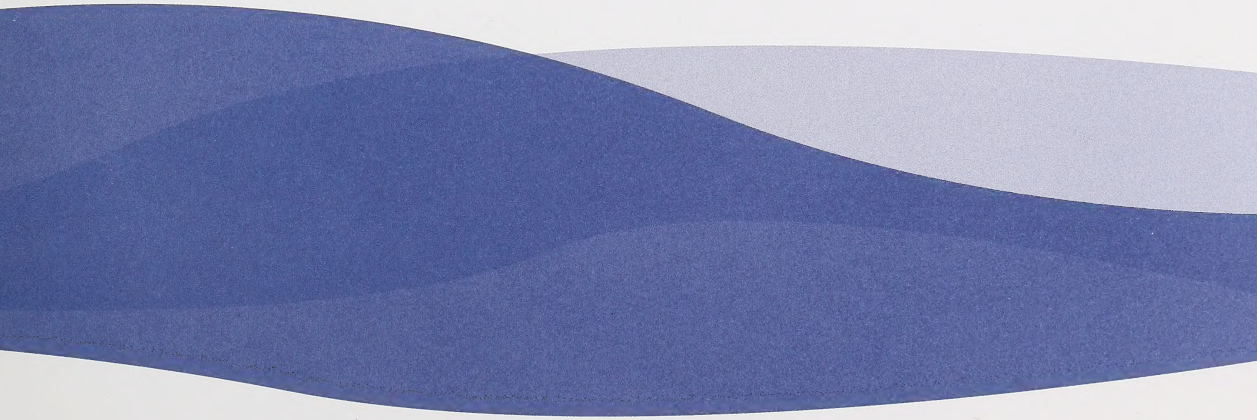

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For addition information on the Advisory Committee on Water Use Practice and Policy, please visit www.waterforlife.gov.ab.ca/html/removed.html

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